



**Noise monitoring during drilling operations
Lower Stumble Well Site
Balcombe, West Sussex**

Report ref.

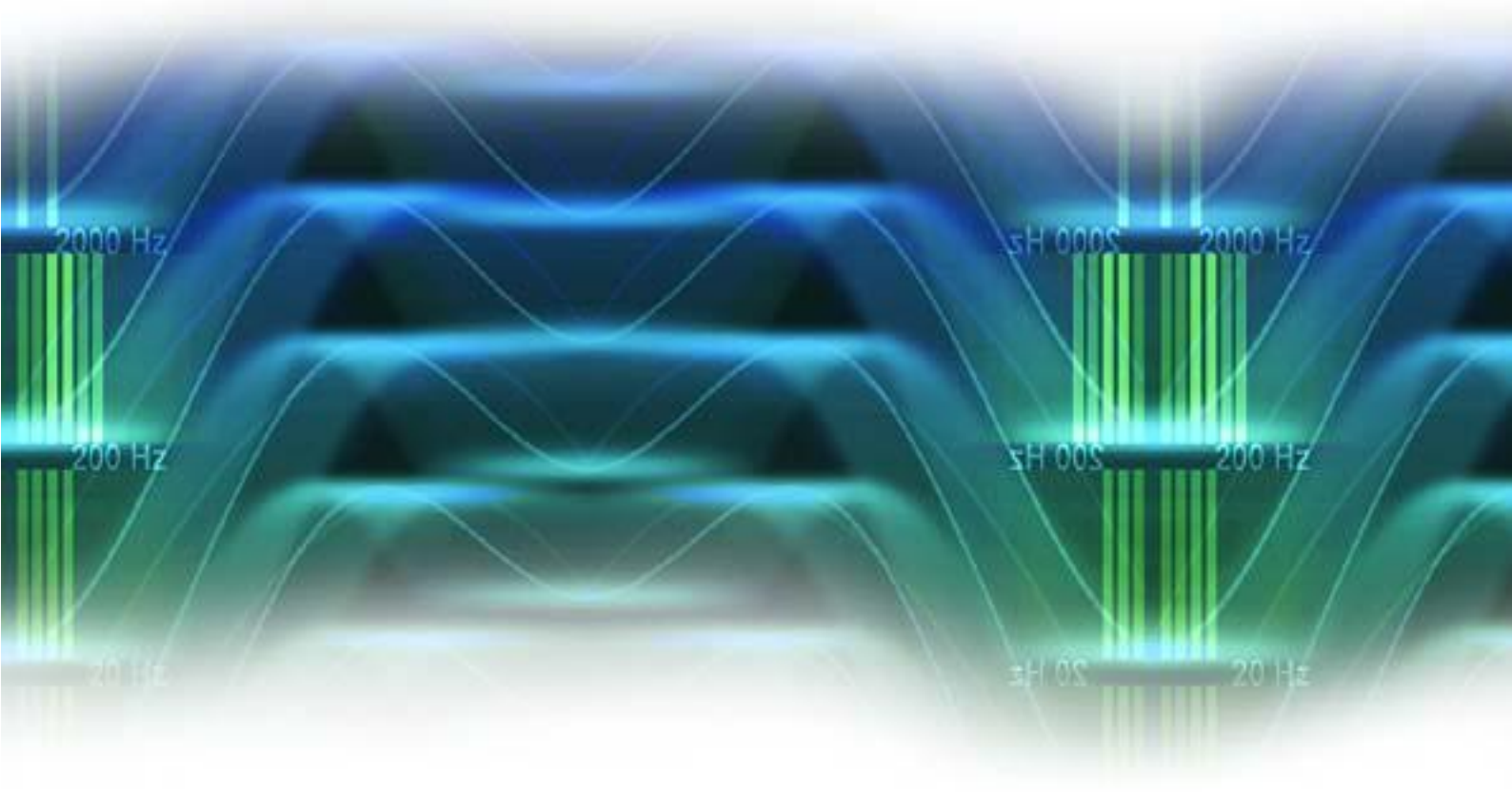
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1. INTRODUCTION

Cuadrilla Resources has commissioned Spectrum Acoustic Consultants to undertake noise monitoring during drilling operations completed at their Lower Stumble well site, located at London Road, Balcombe, West Sussex.

The objective of the noise monitoring exercise is to establish noise levels produced during drilling operations, at the most sensitive community position to the well site, thereby allowing these levels to be assessed in terms of compliance with noise limits set out in planning condition 8, as issued by West Sussex County Council, under application number WSCC/027/10

To fulfil this requirement noise monitoring has been completed by setting up and operating remote noise logging equipment at the residential position closest to the well site, thereby allowing continuous noise level information to be reported during drilling operations.

Interim reports have been compiled and issued, throughout the periods before and following commencement of drilling operations, in order to provide on-going feedback and review of ambient noise and noise levels produced during the early stages of operations. This report provides the results from the noise monitoring survey following the first completed week of main drilling operations at the well site, which may be submitted for information to the Planning Authority.

2. NOISE LIMITS

Noise limits are defined in Condition 7 of the planning consent, detailed as follows:

The corrected noise level for operational noise from the site shall not exceed 55dB(A) LAeq, 1-hour free-field between the hours set out in condition 6 of the planning permission i.e. 0730-1830 Mondays to Fridays and 0800-1300 Saturdays and 42dB(A) LAeq, 5-minutes free-field outside of these hours. Noise levels shall be determined at the nearest residential premises.

3. NOISE MONITORING DURING DRILLING OPERATIONS

3.1 DRILLING DETAIL

Drilling periods to date are as follows:

- Water-well drilling operations 11-14 June 2013
- Main drilling operations 2 August 2013 on-going

3.2 SURVEY DETAILS

The noise survey detailed in this report was completed over the period 29 May to 12 August 2013 taking in a significant period when there were no operations at the well site. Weather conditions during the survey period were inevitably changeable, but reflecting the good summer weather mainly warm and dry, with low winds.



3.3 SENSITIVE RECEPTOR POSITIONS

The noise sensitive receptor location, closest to the well site and therefore used for the purposes of the noise monitoring, are described in table 1 and figure 1 below.

Position RP1: Kemps Farm, London Road	This position is at Kemps Farm; a farmhouse located off London Road, south of Balcombe and situated 400m north of the well site. This position is representative of the nearest residential property to the exploration site.
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Table 1 Description of noise monitoring positions

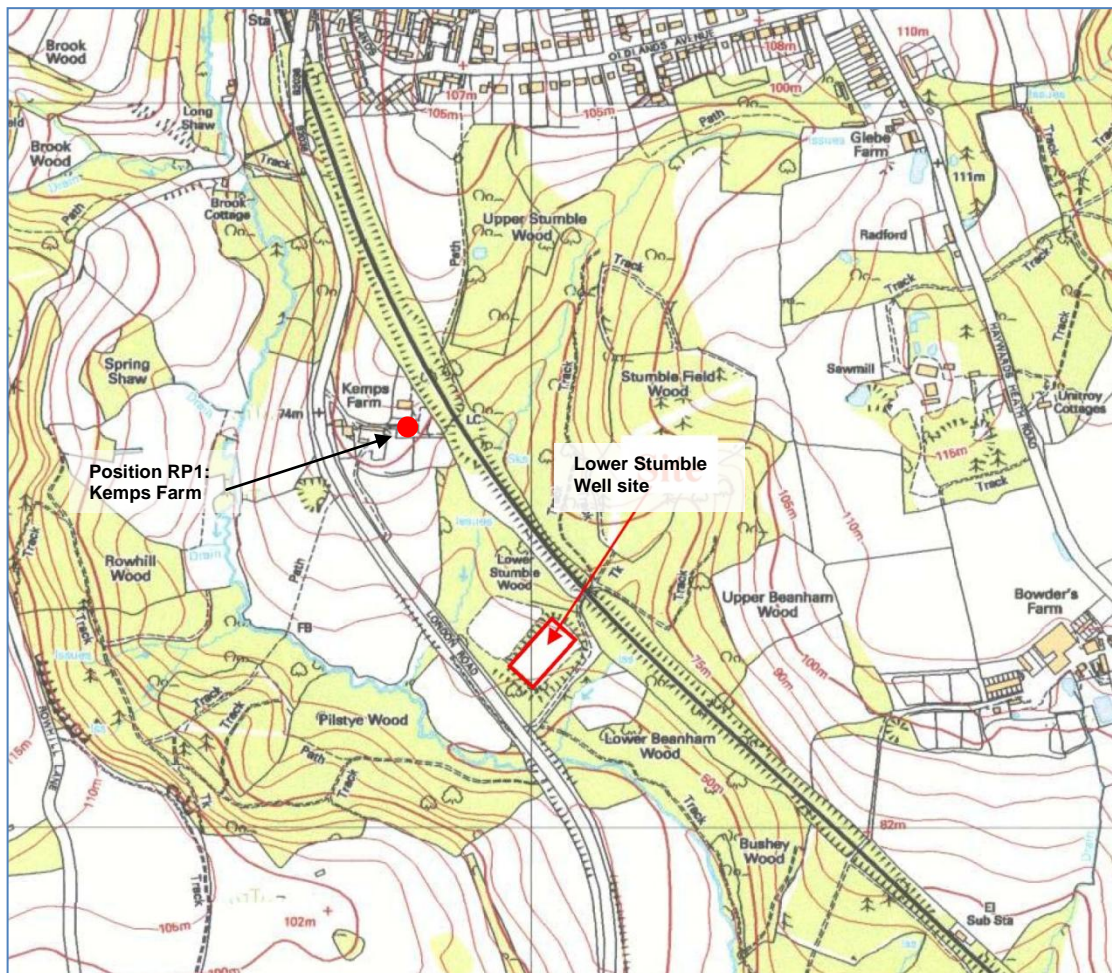


Figure 1: Plan showing Lower Stumble Well Site and noise receptor position

3.4 INSTRUMENTATION

The following instrumentation was used to measure noise levels during the survey:

- 1 x Bruel & Kjaer Type 2238 Sound level Meter, using type 4189 ½" Microphone
- 1 x Bruel & Kjaer outdoor microphone kits type UA 1404
- 1 x Bruel & Kjaer acoustic calibrator



All measuring equipment is calibrated in accordance with manufacturer's requirements using equipment referenced to the British Calibration Service and The National Physical Laboratory.

3.5 SURVEY PROCEDURE

Noise measurements were recorded generally in accordance with procedures detailed in BS4142:1997: Method for rating industrial noise affecting mixed residential and industrial areas. Noise samples of 5-minutes duration were recorded over the survey period to provide information on the ambient noise (without site operations) together with noise levels produced by drilling and associated operations.

To assess noise emission levels during drilling operations, noise samples were recorded in terms of LAeq, the equivalent continuous noise level and also the LA90 percentile level. Briefly, LAeq the equivalent continuous noise level is commonly used as the measure of total ambient noise or noise from a specific source. LA90 is the level exceeded for 90% of the time and is defined in BS4142, as the measure of background noise, when it is applied to the residual noise level (the noise in the absence of the specific noise being assessed), however, in the presence of a steady noise source (as in this case) LA90 describes the steady noise from this source.

Whilst expressing noise limits from a source in terms of LAeq is standard practice, direct measurement of a specific noise level in terms of LAeq can be difficult, particularly when the source, as in this case, is at significant distance from the receptor and there are other intermittent sources, such as local road and rail traffic, which will largely influence the LAeq measurement. Measurements in terms of LA90 filter out contributions from intermittent sources and, as noise emission from drilling operations is generally relatively steady, the expectation would be that the LA90 level would be a reasonable descriptor of the steady noise from these operations. Accordingly, measurements in terms of LA90 will be used as the primary indicator of whether noise levels during drilling and associated operations meet noise limits.

3.6 NOISE SURVEY RESULTS

Due to the significant quantity of data resulting from the 5-minute noise samples taken from the long-term monitoring survey the results are best presented in graphical format.

Charts 1 to 11 following illustrate the 5-minute sample data, recorded in terms of the LA90 and LAeq measurement descriptors. Periods which include drilling operations (covered by charts 3, 10 and 11) are noted with an orange line.

The noise limit applicable to the drilling operations, as detailed in Condition 7, is shown as a purple dashed line on each chart. Noise emission from drilling operations is steady not irregular, nor does it commonly exhibit tonal or impulsive content. Consequently no character penalty has been added to the specified noise limits.

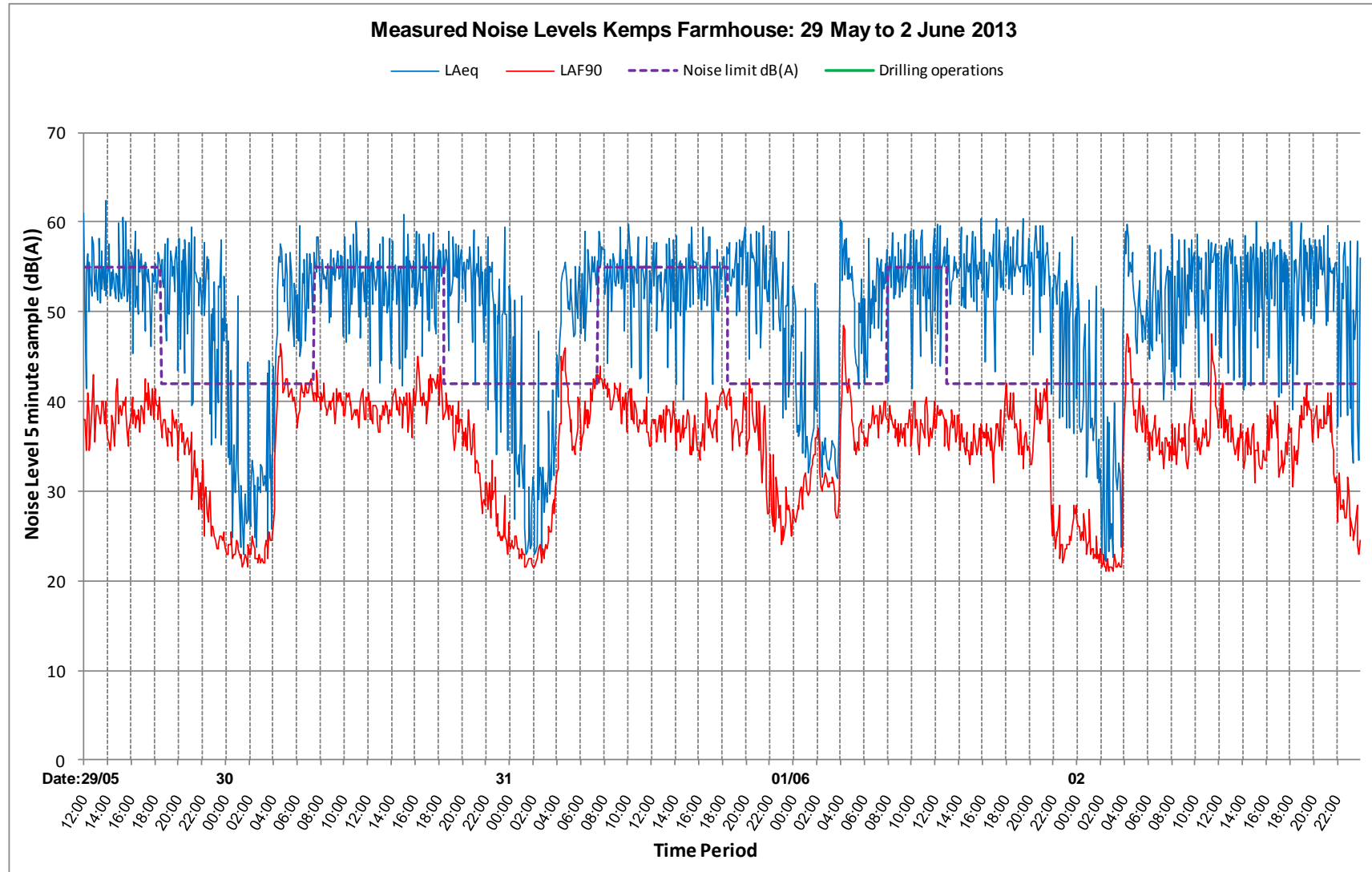


Chart 1: Noise measurement data position RP1: 29 May to 2 June 2013

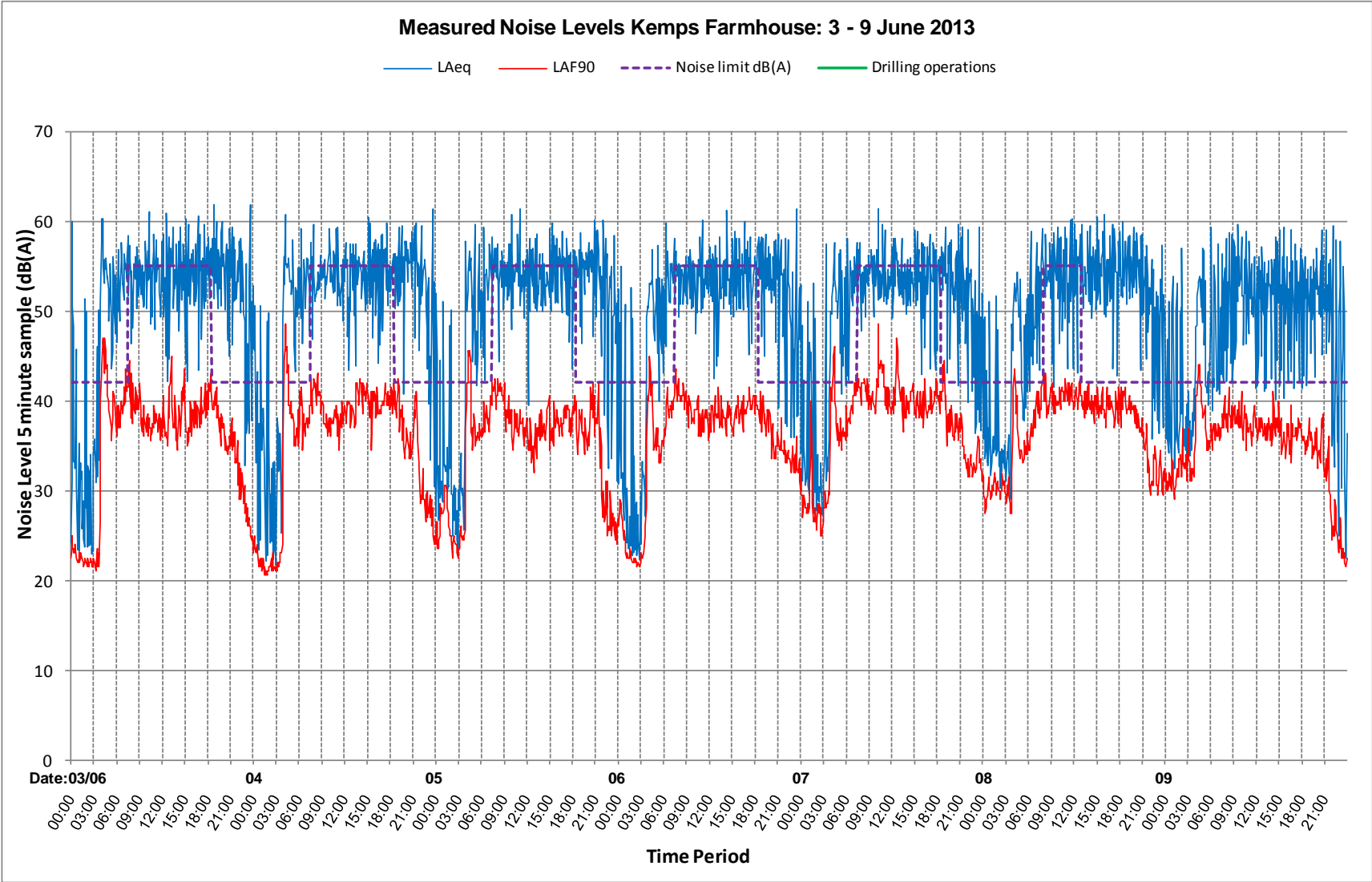


Chart 2: Noise measurement data position RP1: 3 -9 June 2013

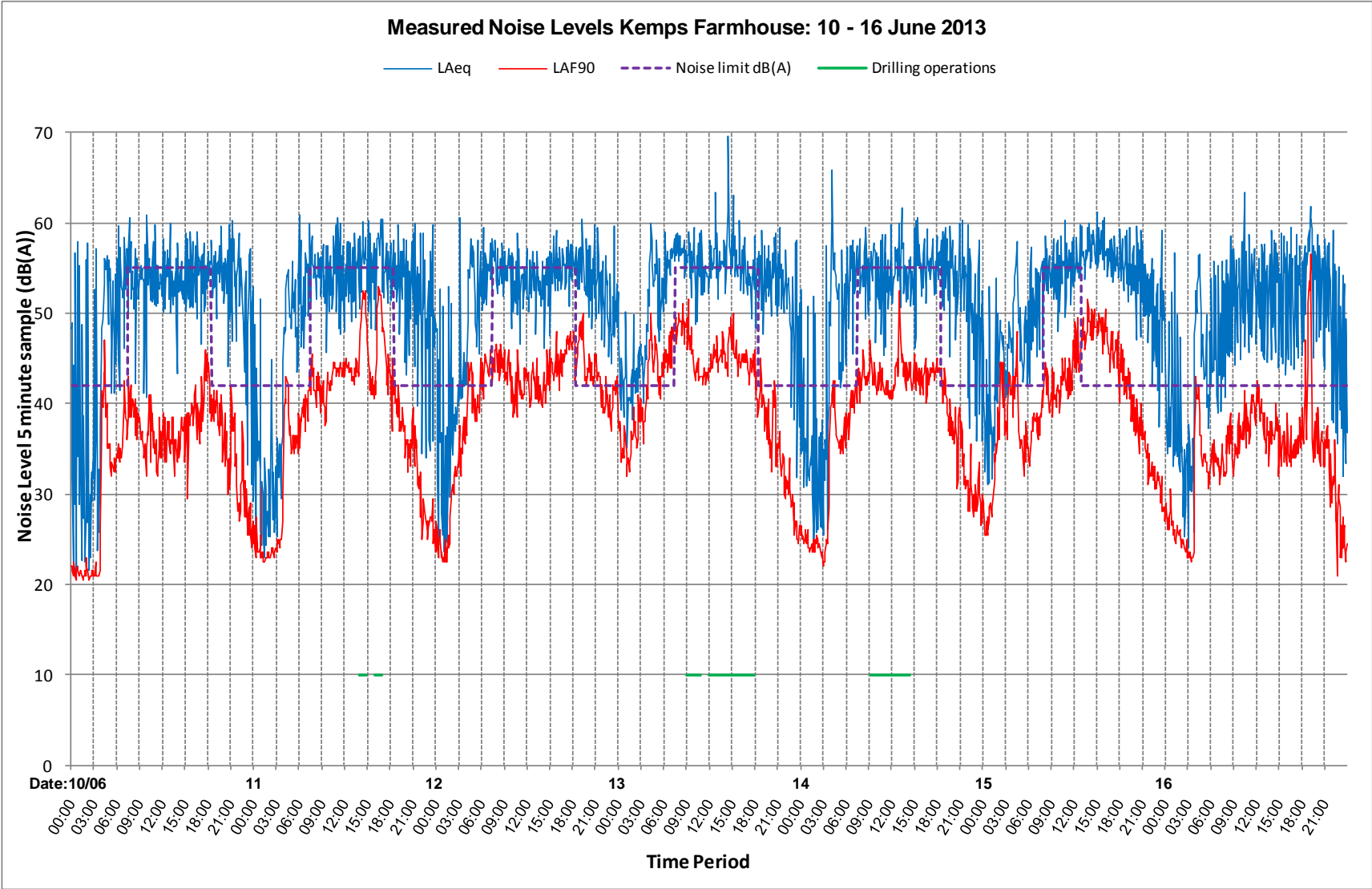


Chart 3: Noise measurement data, position RP1: 10-16 June 2013

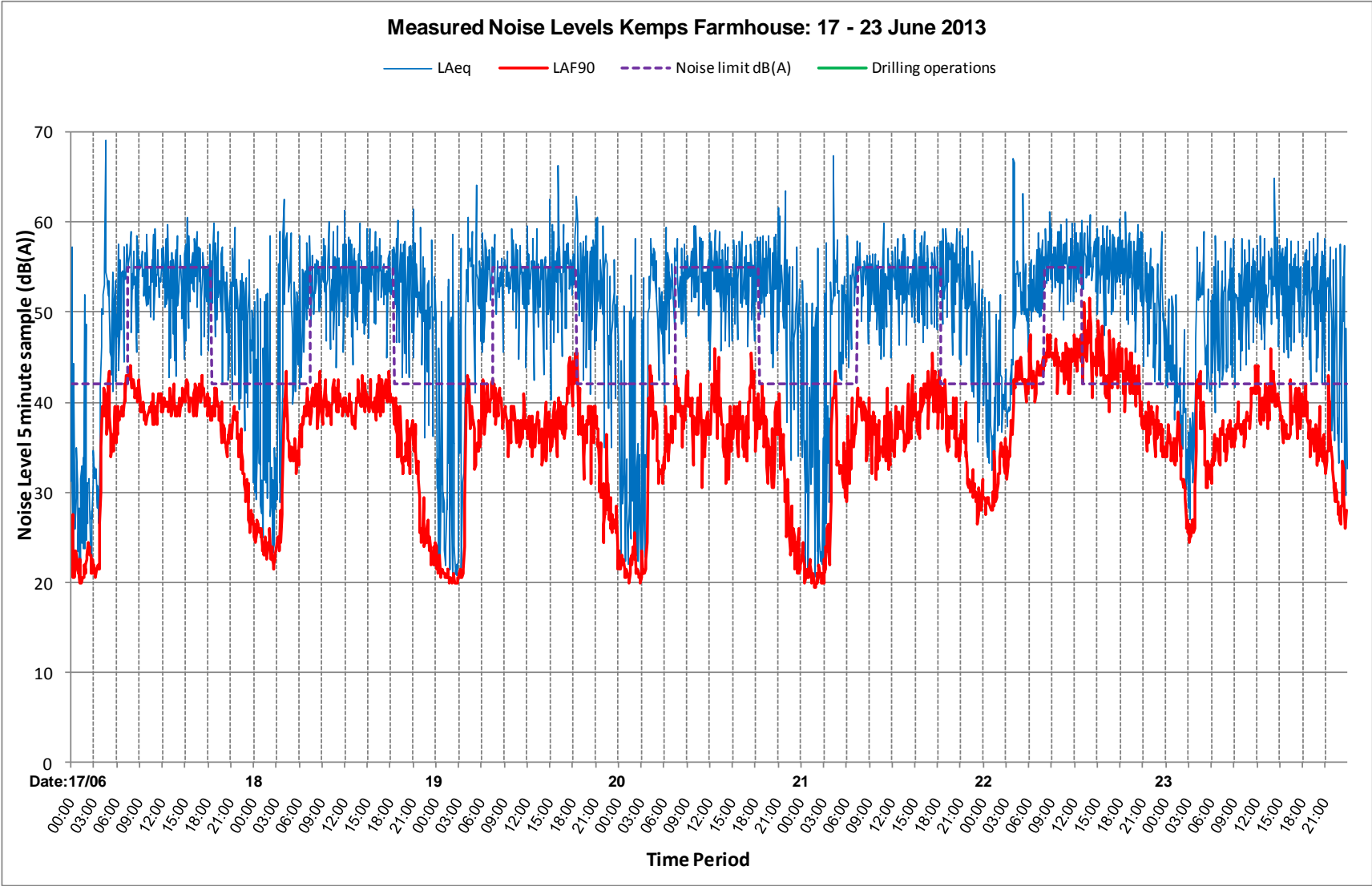


Chart 4: Noise measurement data, position RP1: 17-23 June 2013

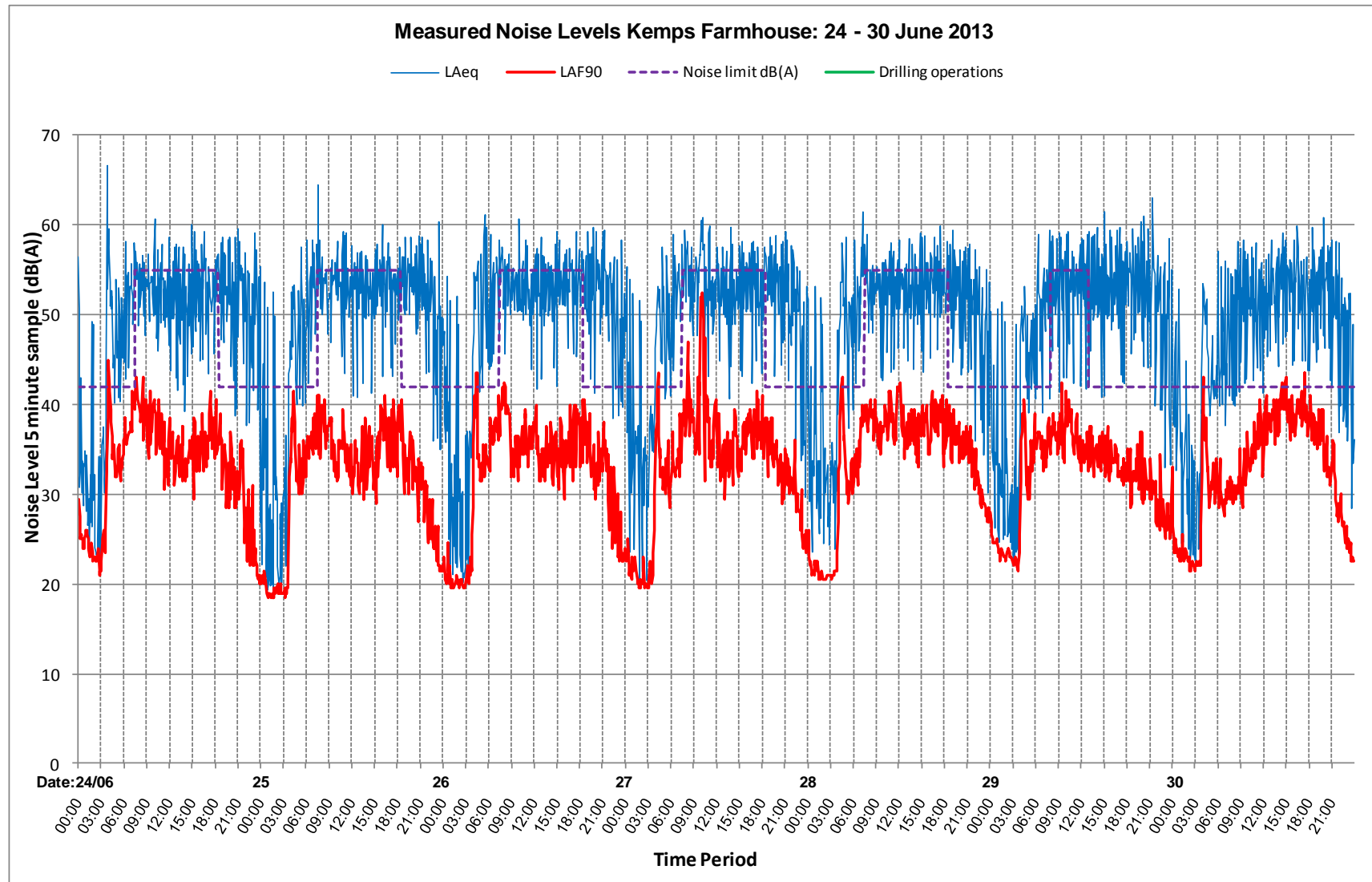


Chart 5: Noise measurement data, position RP1: 24-30 June 2013

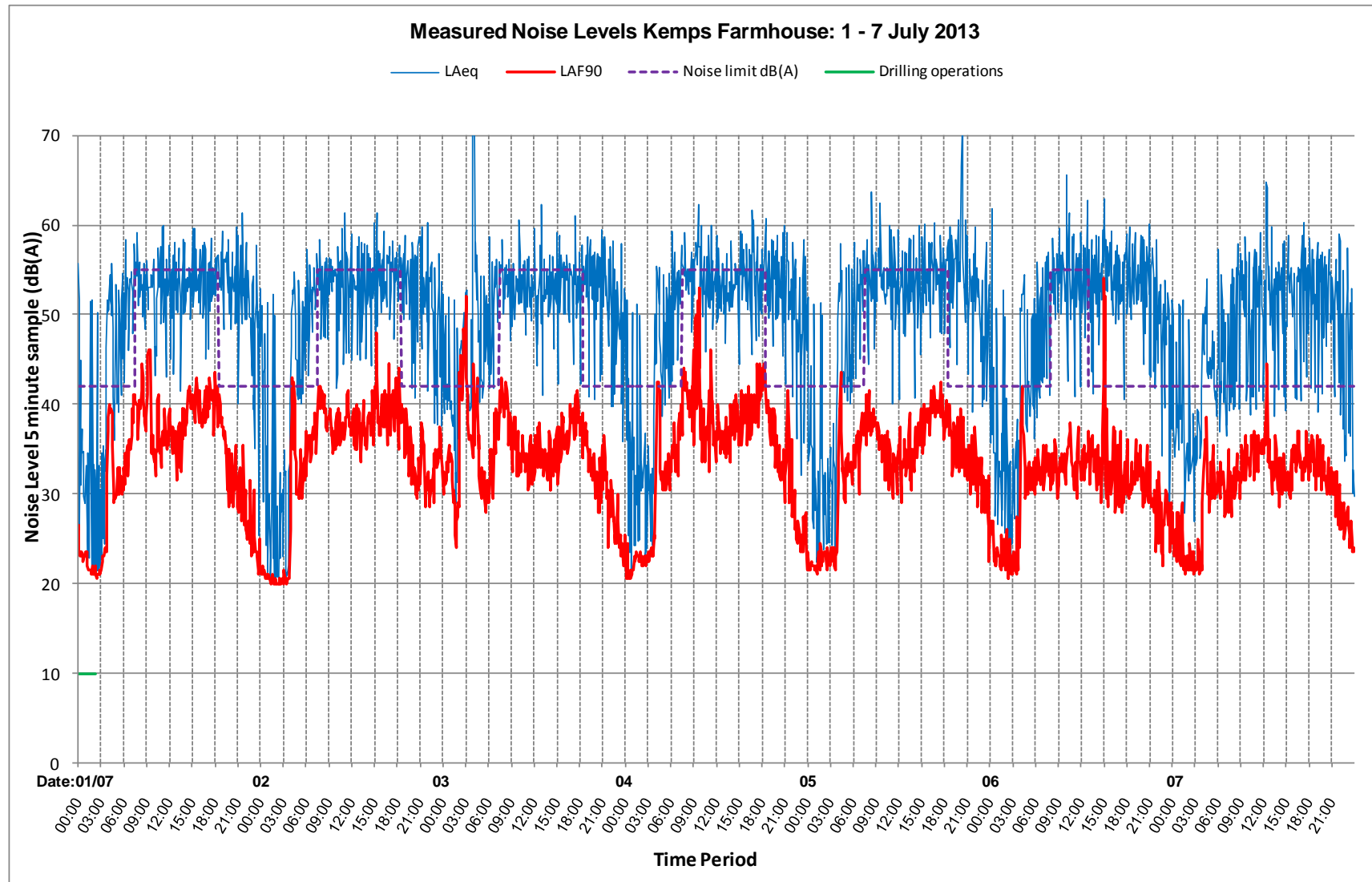


Chart 6: Noise measurement data, position RP1 1-7 July 2013

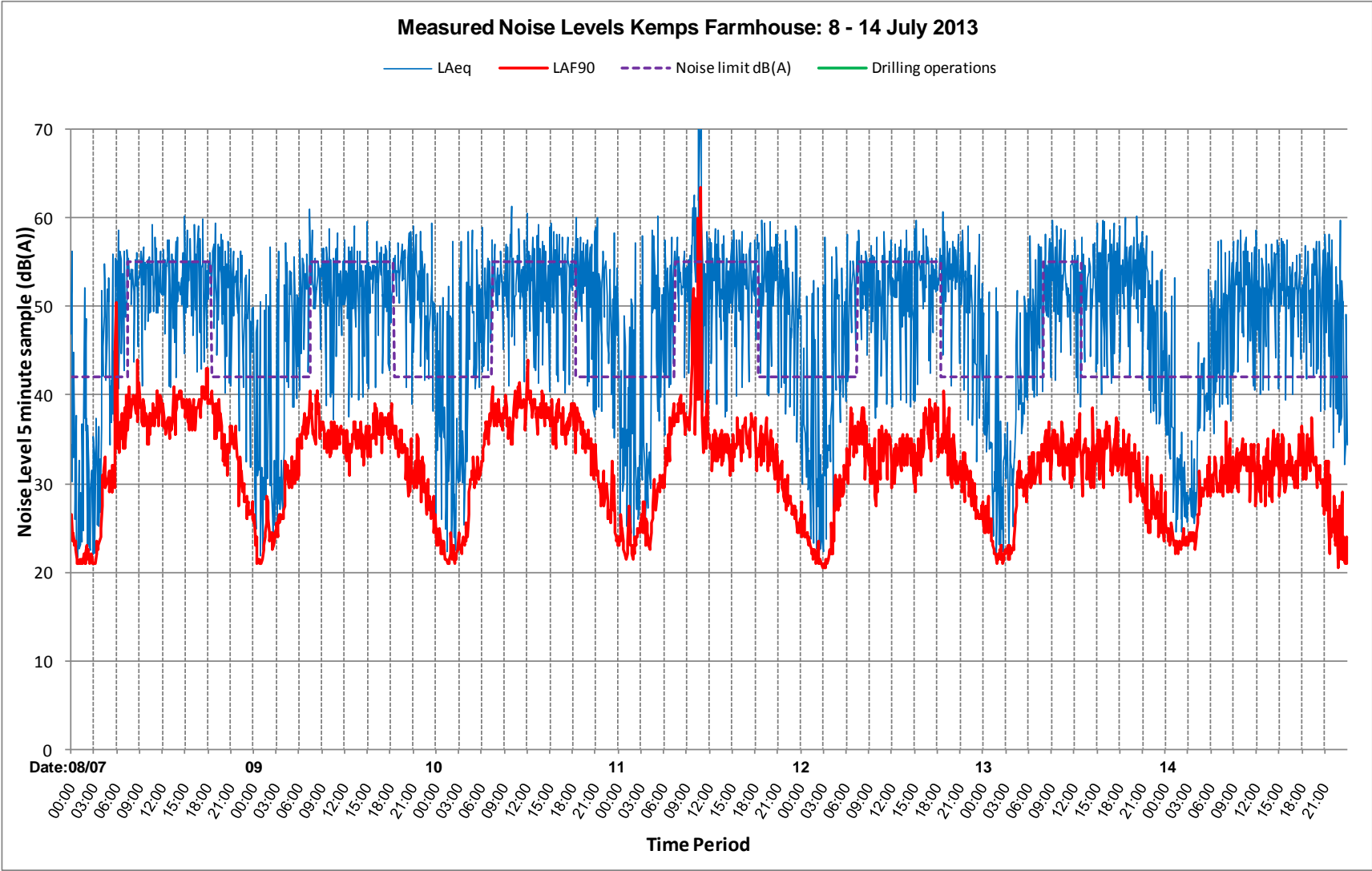


Chart 7: Noise measurement data, position RP1: 8-14 July 2013

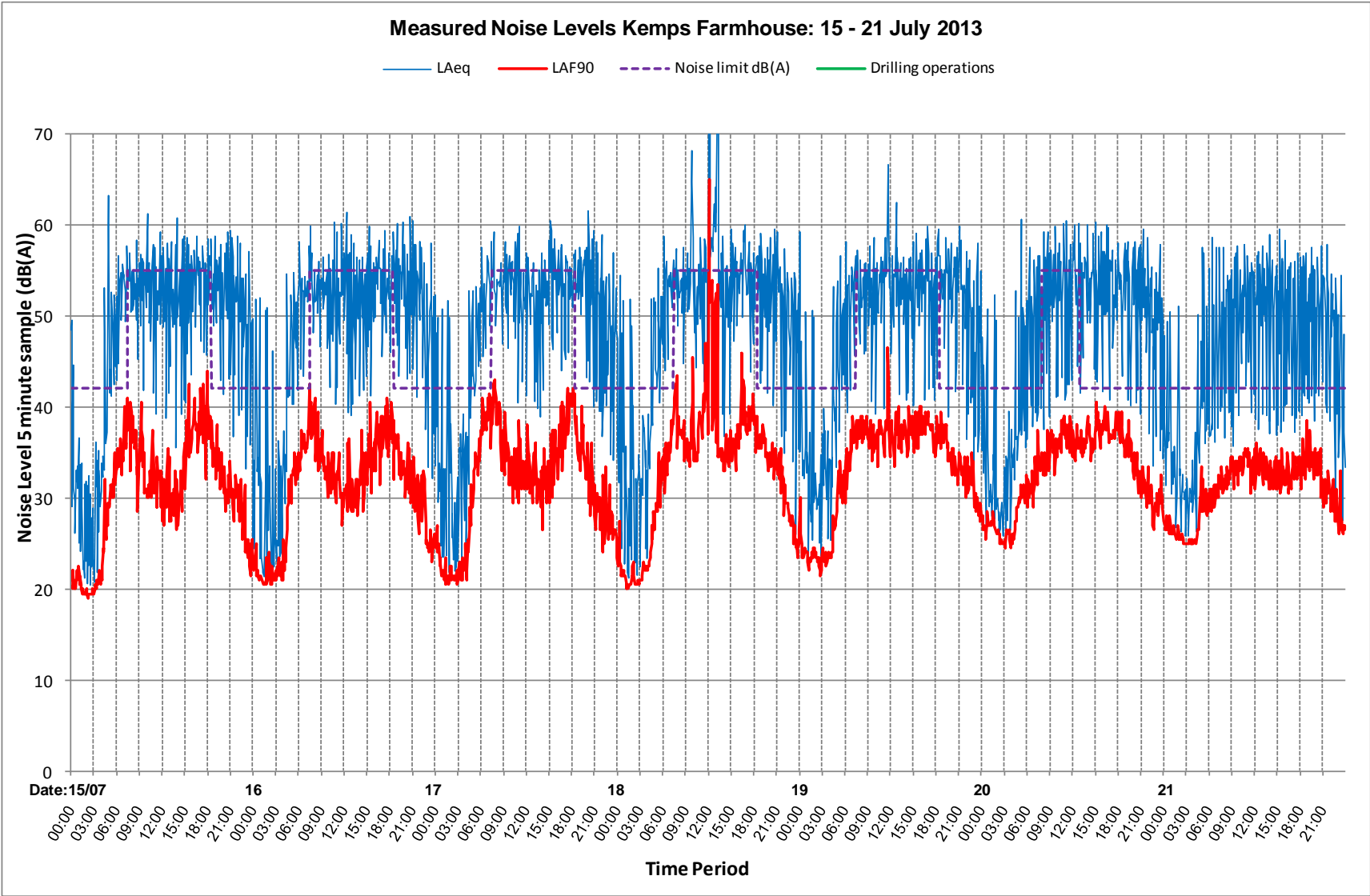


Chart 8: Noise measurement data, position RP1: 15-21 July 2013

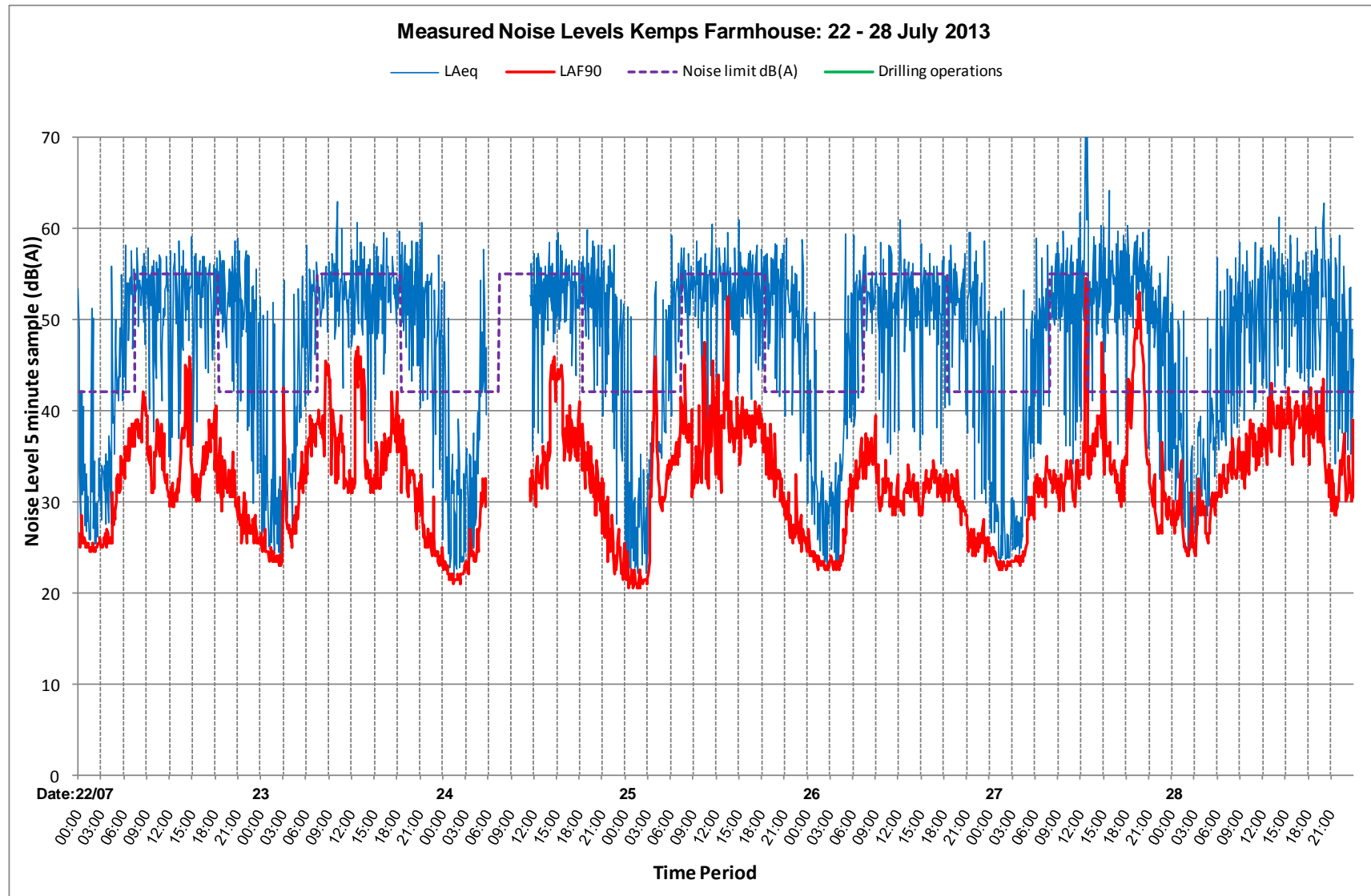


Chart 9: Noise measurement data, position RP1: 22-28 July 2013

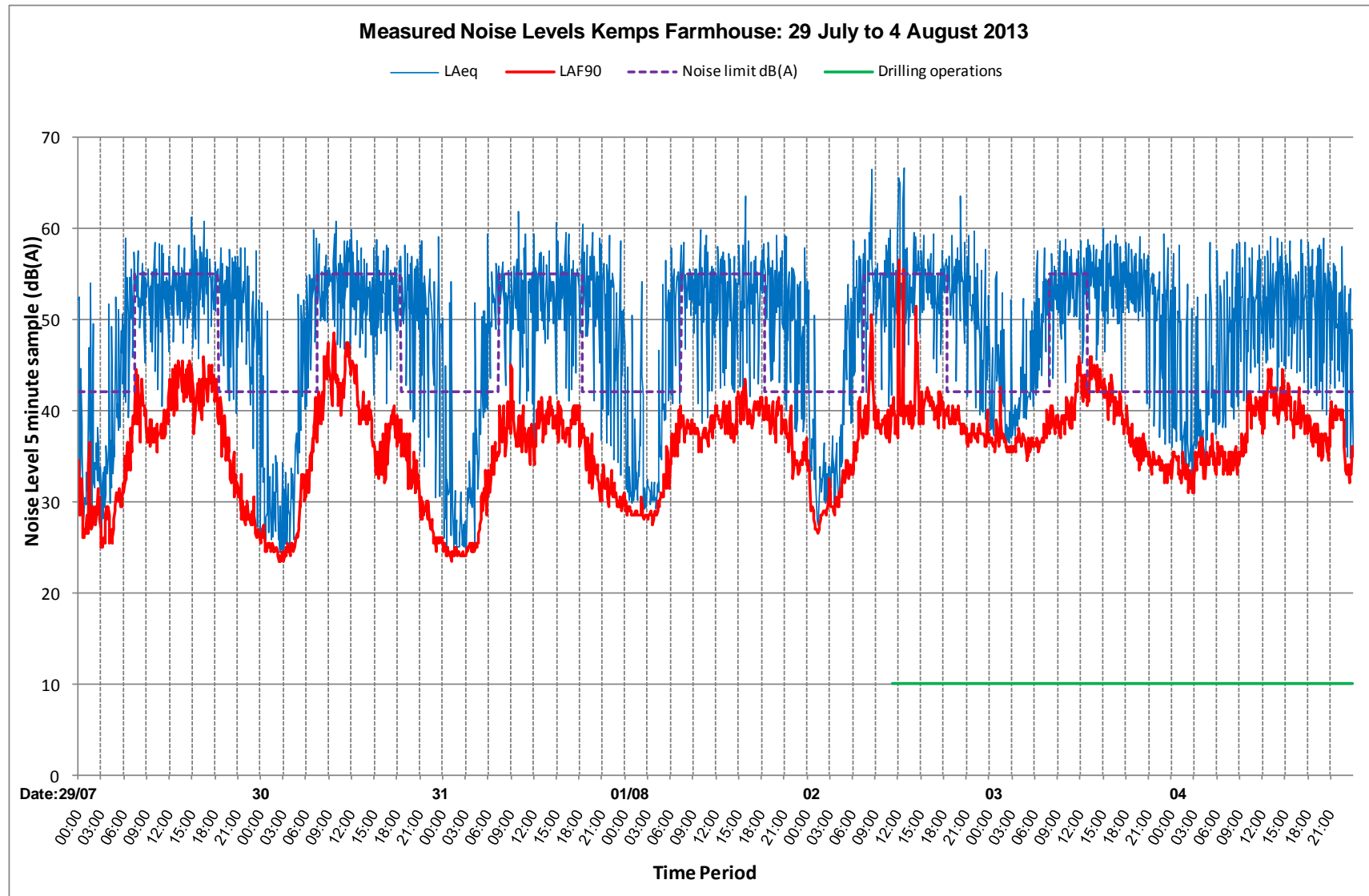


Chart 10: Noise measurement data, position RP1: 29 July to 4 August 2013

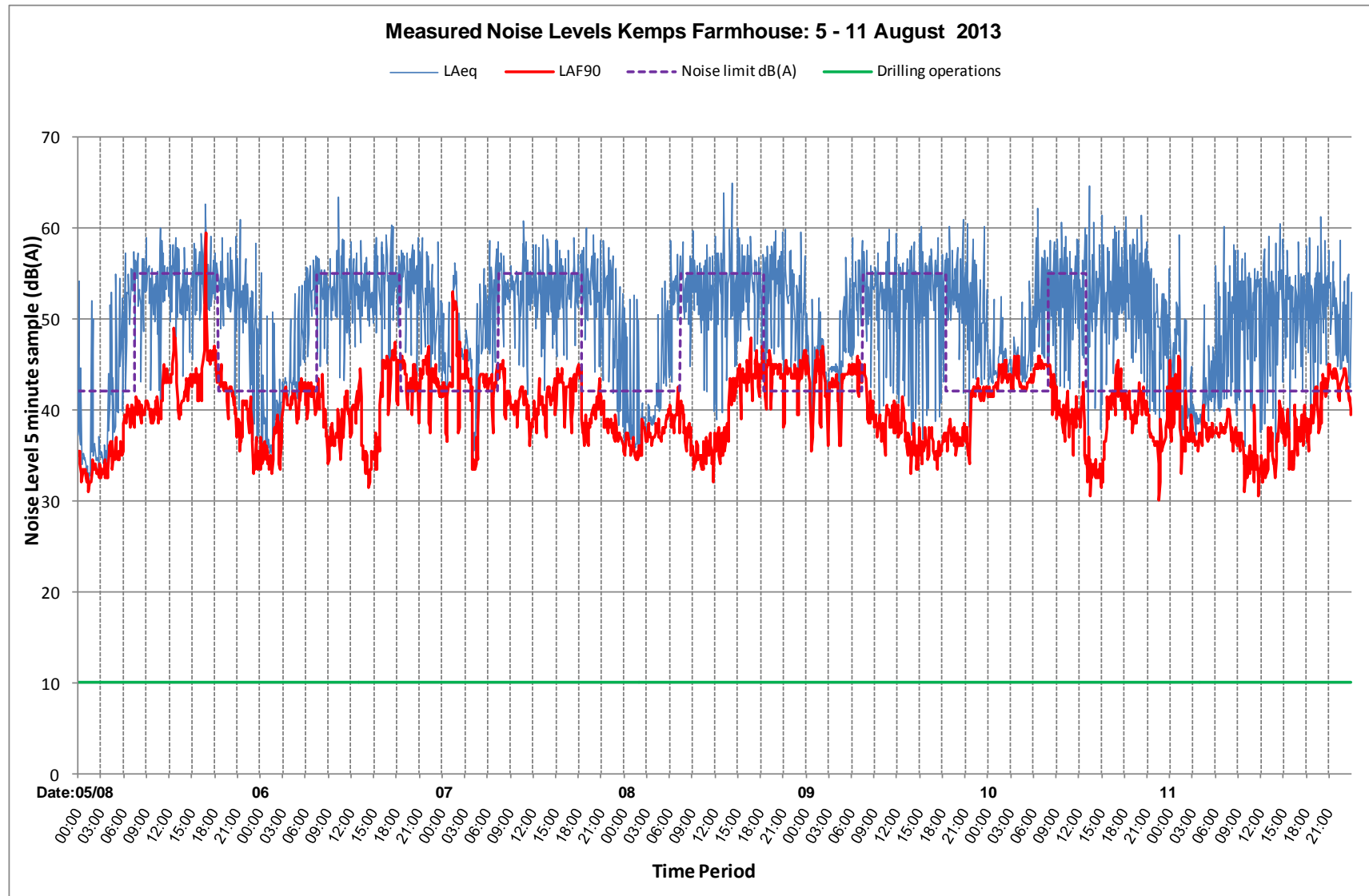


Chart 11: Noise measurement data, position RP1: 5-11 August 2013



When reviewing the noise data illustrated on the charts it should be noted that environmental noise levels at, or around, the daytime 55dB(A) limit and particularly the 42dB(A) evening and night time limit can easily be generated by moderate wind conditions and local activity noise. The identified noise limits are set at a low level to reflect the rural context and, as a consequence, even modest changes in localised noise conditions will markedly influence the noise data. The ambient LAeq levels are particularly influenced by intermittent noise from such sources as local activity around the house receptor position and from local road and rail traffic. In this context, it is noteworthy that local conditions have changed significantly during the period of survey due to organised demonstrations, and the associated activities of the police. Such local activity noise is likely to produce LAeq levels in excess of the stated noise limits, so this data is not representative of noise from any drilling operations. Indeed, a review of all the results charts indicates that the LAeq (blue curve) profile is unchanged during periods of drilling.

Much of the total noise monitoring period, apart from the water-well drilling operations between 11-14 June and the main drilling operation following 2 August is just representative of normal ambient noise, or noise that is already present prior to any well site operations. The periods covered by charts 3, 10 and 11 include drilling operations at the well site, when the highest noise emission would be most likely. A review of produced noise levels, and particularly the LA90 levels over these periods, provides the best indication of the specific noise from the well site operations at the receptor position.

4. NOISE LIMIT COMPLIANCE CHECK

The purpose of long period continuous monitoring of the well site operations, directly at a residential receptor position, is to provide a general overview of noise levels produced during drilling operations and also to provide a continuous record of noise measurement that may be reviewed should there be any complaint made by residents with regard to noise.

Due to the presence of both extraneous noise from other local sources and wind generated noise it is not always possible to assess, or verify, compliance with a relatively low noise limit by direct noise measurement at a distant location, particularly during the daytime when ambient noise levels are higher.

However, a review of the first 3-days of drilling operations (Chart 10, 2-4 August) indicates that there was no change to the daytime LA90 levels (35-45dB(A)), demonstrating that over this period any drilling noise was not contributing significantly to daytime noise. During the same period the LA90 levels over the night time fell to around 34-38dB(A), whereas these levels are shown to fall to below 30dB(A) prior to commencement of drilling operations. The indication is therefore that over this period the contribution from the drilling operations was at this level of between 34-38dB(A) and thus within the 42dB(A) limit.

During the week period 5-11 August 2013 (chart 11) LA90 noise levels during well site operations are shown to be within the noise limits for the majority period. Whilst there were some occasions when noise levels increased slightly above 42dB(A) (to around 45dB(A)), LA90 levels recorded prior to drilling operations were also shown on occasions, to be above the noise limits, so the minor excesses would not be significant. Occasional short term 'spikes' to the LA90 levels, to above 50dB(A), are also shown in the noise profiles recorded before and following drilling operations and are therefore likely to be caused by local activity.



The indication from the noise monitoring is therefore that the noise limits during well site operations are being met.

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